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Jimbo et al.

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(54) **CONNECTOR**

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CPC ***H01R 13/595*** (2013.01); ***H01R 9/226*** (2013.01); ***H01R 13/506*** (2013.01); *H01R 2105/00* (2013.01)

(58) **Field of Classification Search**
CPC .. H01R 9/226; H01R 2105/00; H01R 13/595; H01R 13/506
USPC 439/76.2, 207–212, 110
See application file for complete search history.

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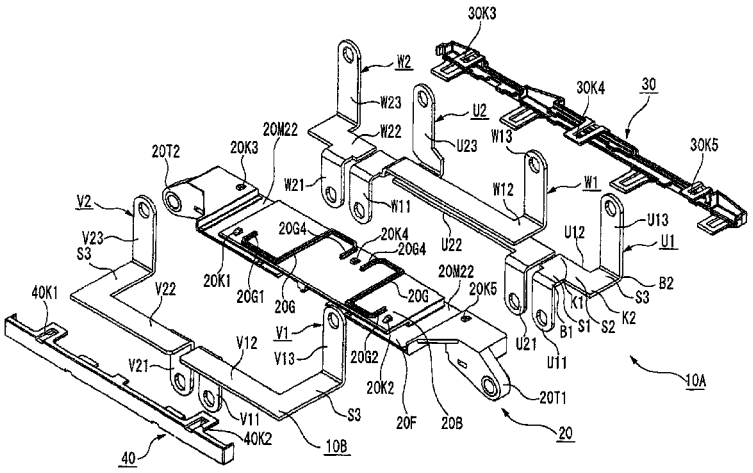
(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

A connector includes a busbar, a housing and a cover. The busbar includes a first connection part extending in a first direction, a second connection part extending in a second direction opposite to the first direction at a position displaced from the first connection part in a direction orthogonal to the first direction, and a coupling part extending in a direction orthogonal to the first direction and the second direction and coupling the first connection part and the second connection part. The housing includes at least one accommodation groove accommodating the coupling part, and a slit through which one of the first connection part and the second connection part is inserted. The cover covers the accommodation groove.

5 Claims, 9 Drawing Sheets



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H01R 13/506 (2006.01)
H01R 105/00 (2006.01)

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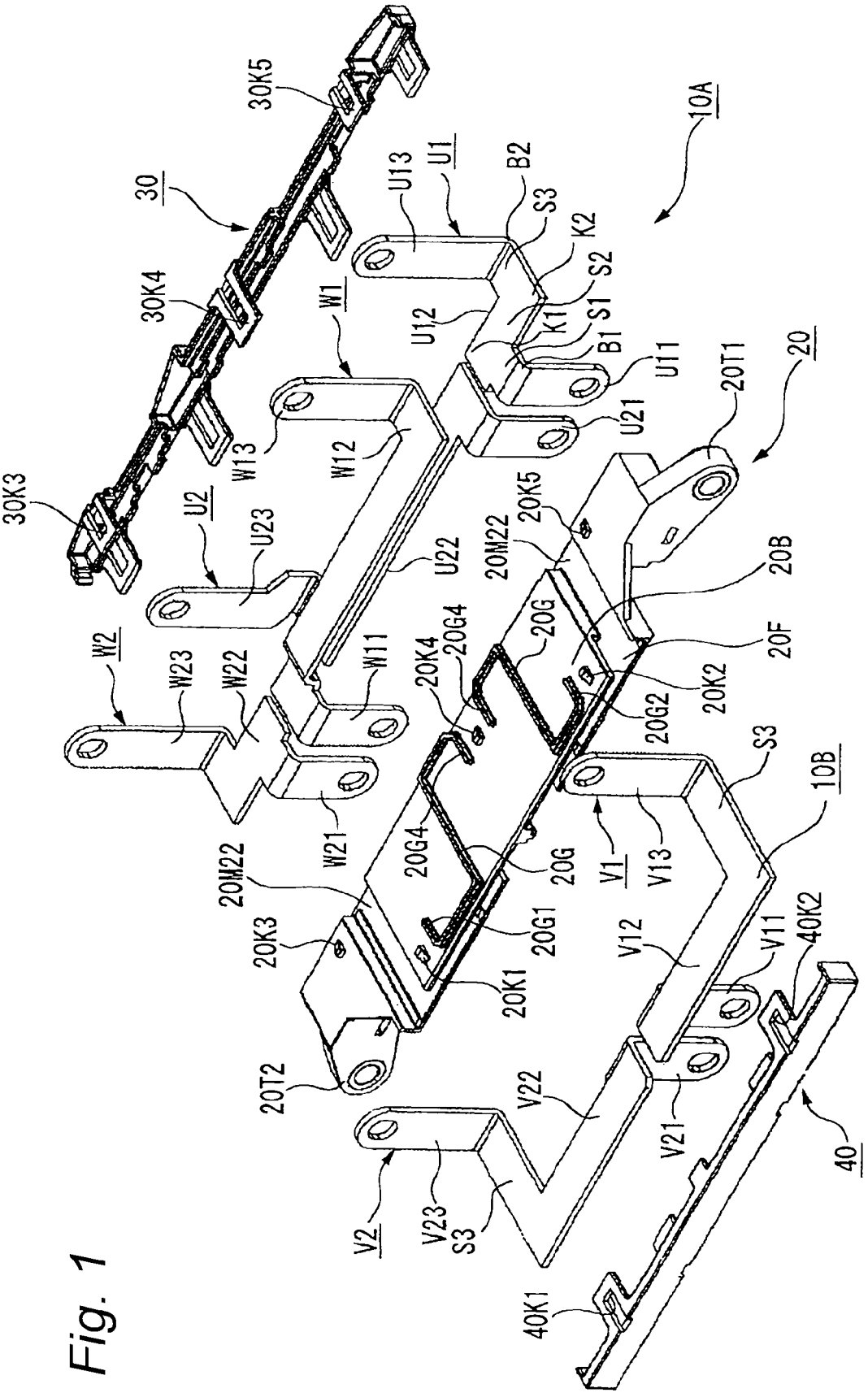
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30K4
30K3
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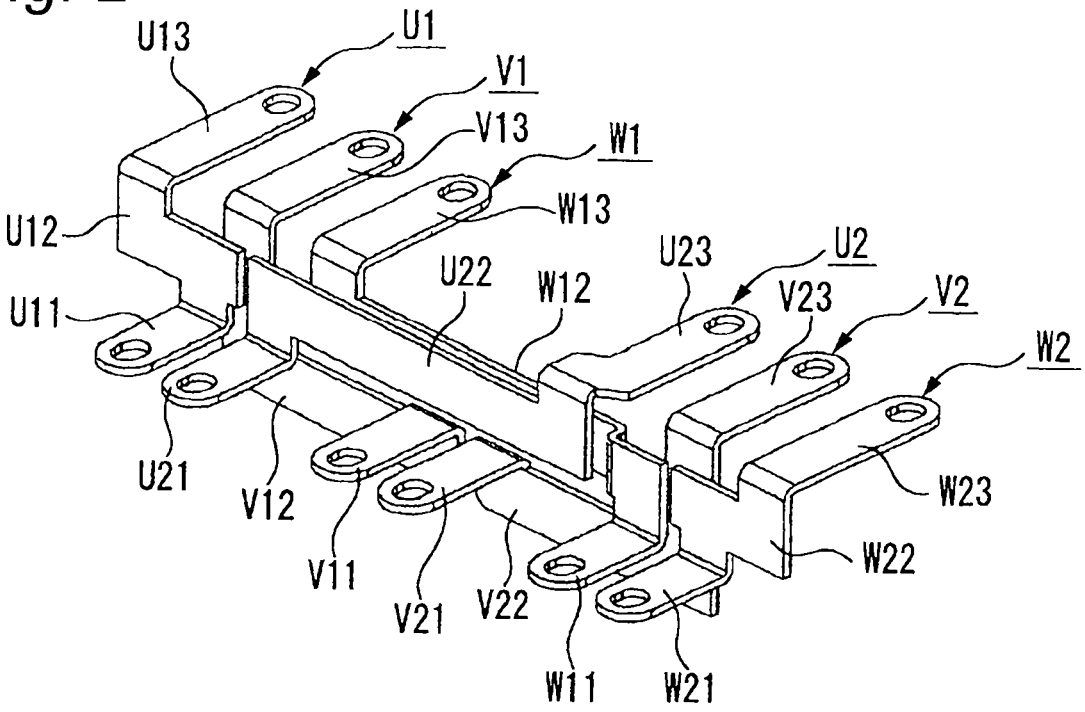
W23
W22
W21
W1
W13
W12
W11
U2
U23
U22
U13
U1
U12
U11
U21
B2
S3
K2
S2
K1
S1
B1
10A
20T1
20
20K5
20M22
20B
20G
20F
20K4
20G4
20K2
20G2
20G1
20K1
20K3
20T2
10B
V1
V13
V12
V11
40K2
V22
V21
V2
V23
S3
40
40K1

Fig. 1

Fig. 2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U1
V1
V13
W1
W13
U12
U23
U2
U22
W12
V23
V2
U11
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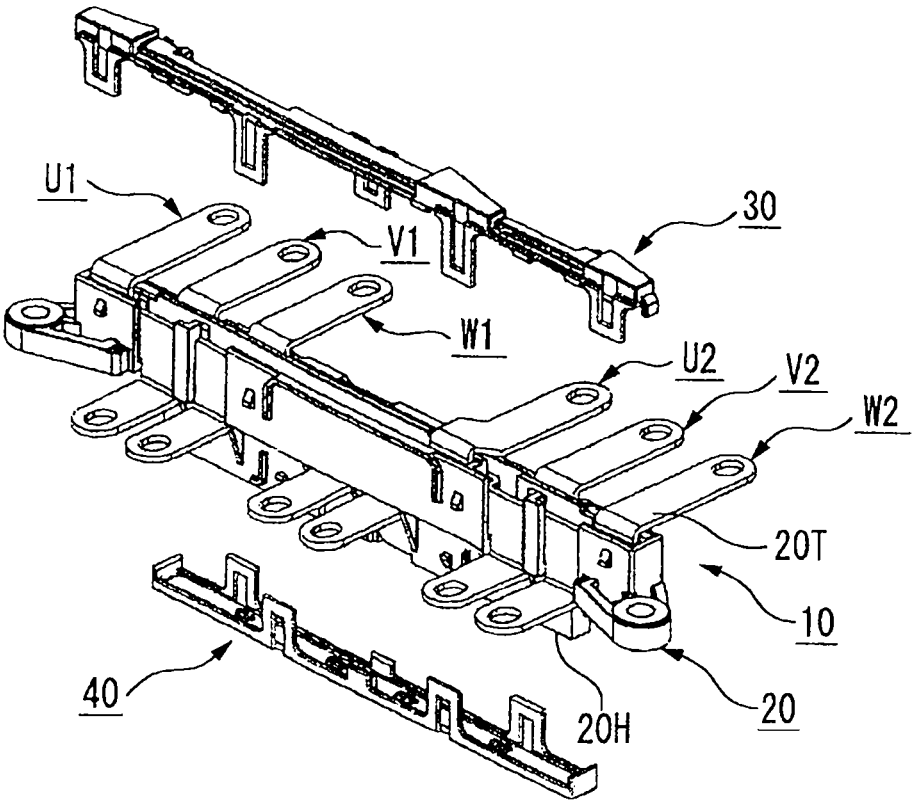
V11
W22
V21
V22
W11
W21

Fig. 3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V1
W1
U2
V2
W2
20T
10
40
20H
20

Fig. 4

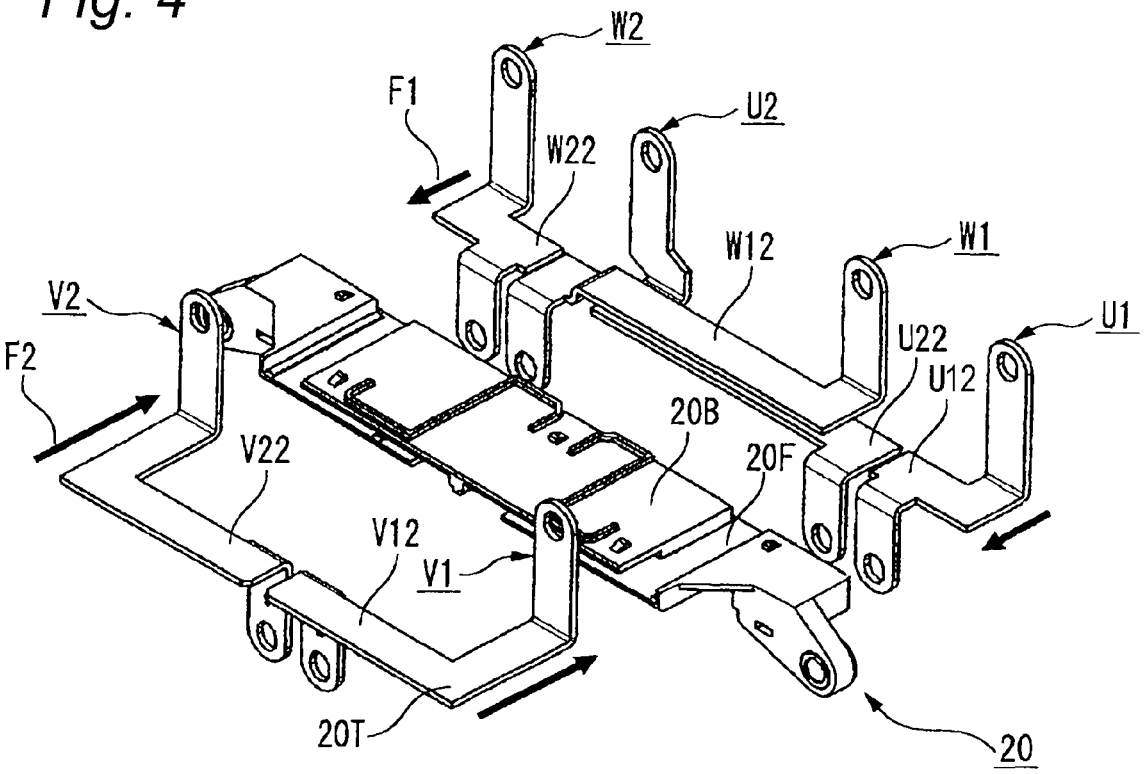


Fig. 5

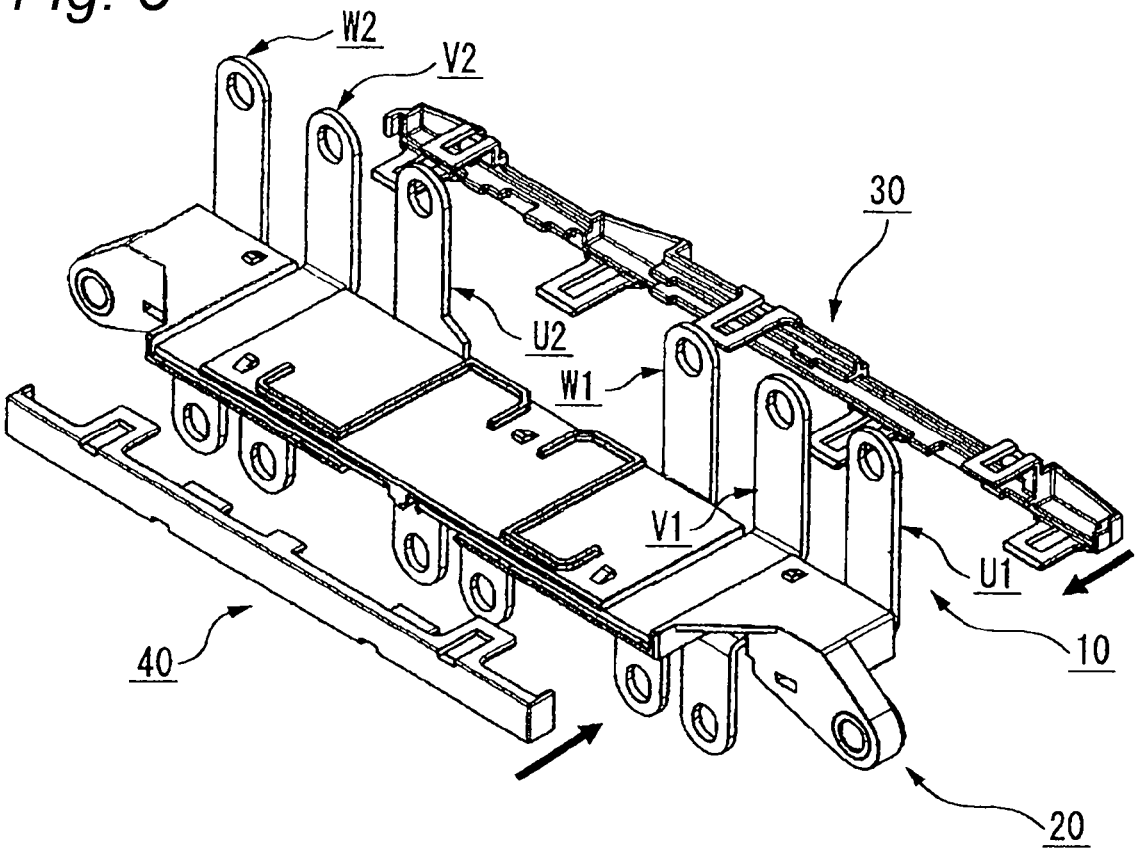


Fig. 6A

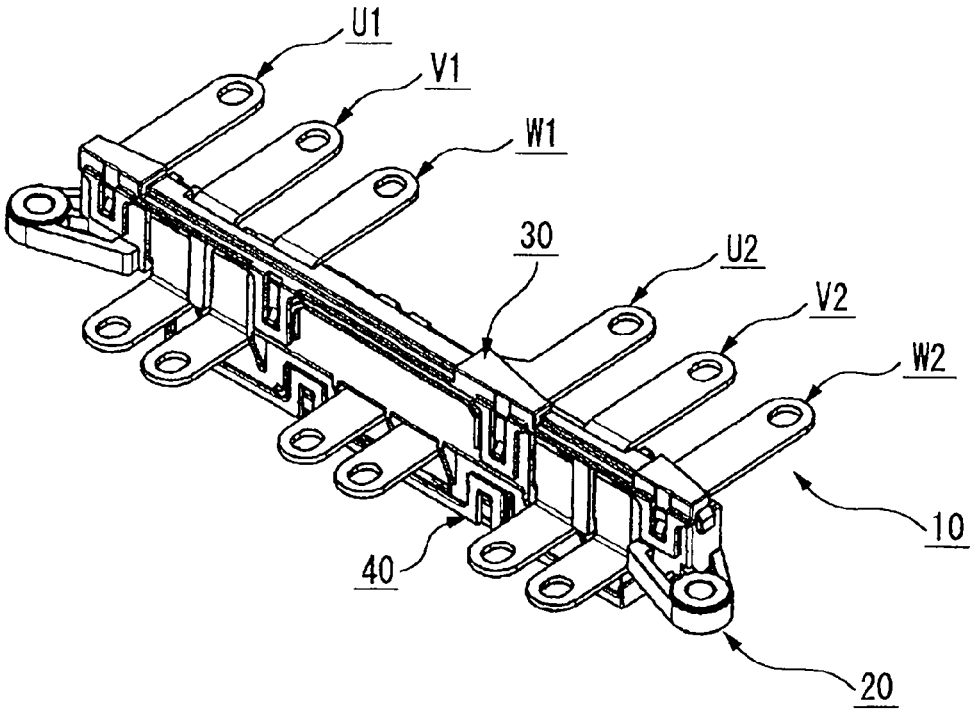


Fig. 6B

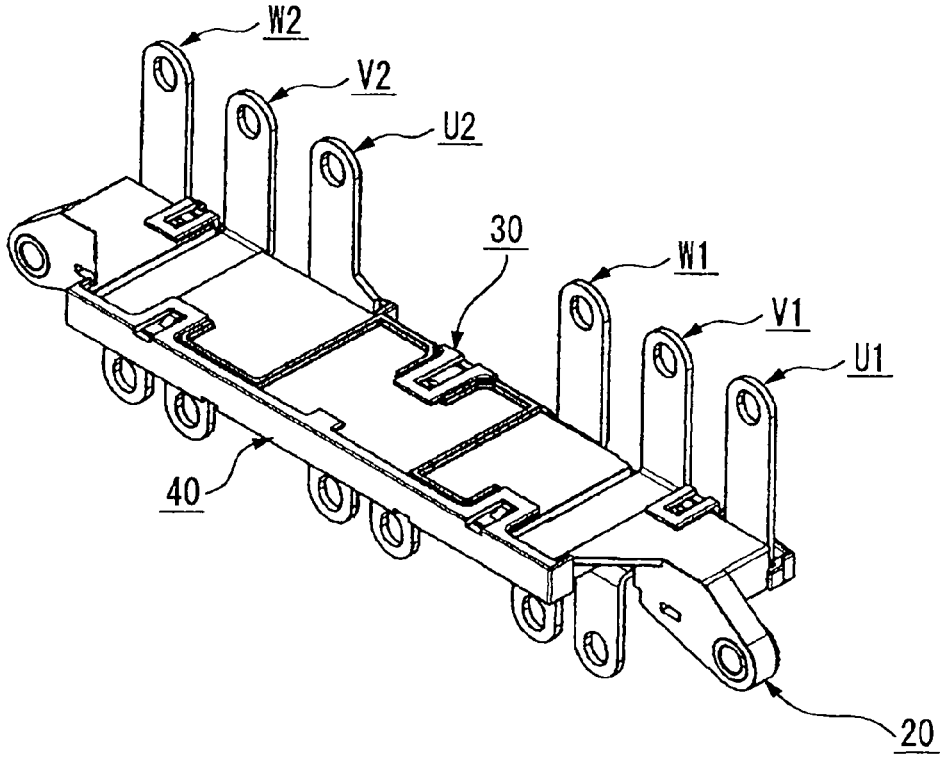
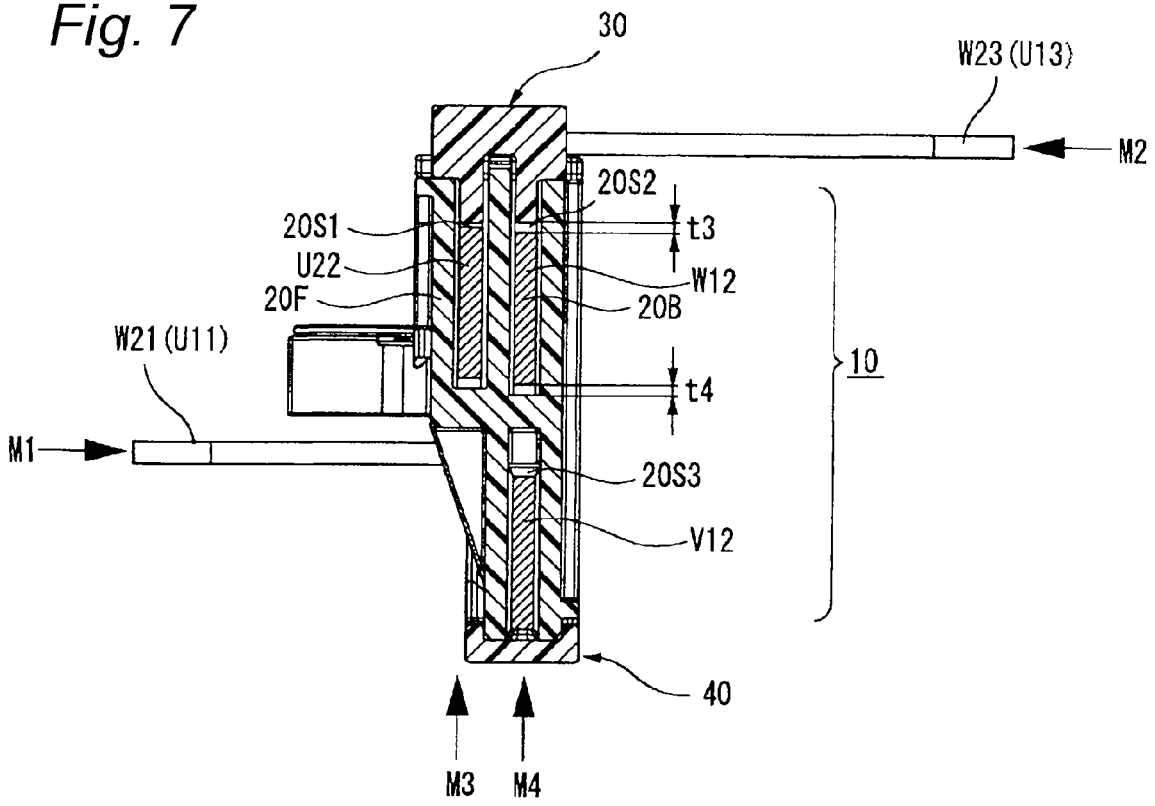


Fig. 7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W23 (U13)
M2
20S2
20S1
t3
U22
W12
20F
20B
W21 (U11)
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t4
M1
20S3
V12
40
M3
M4

Fig. 8A

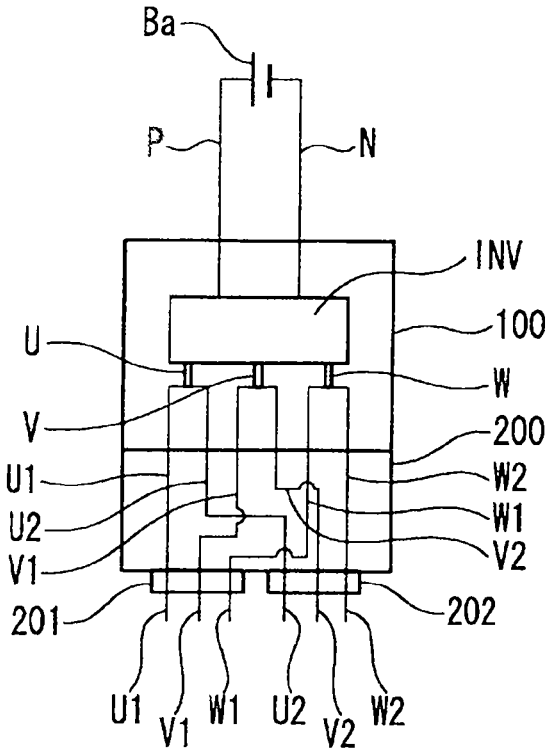
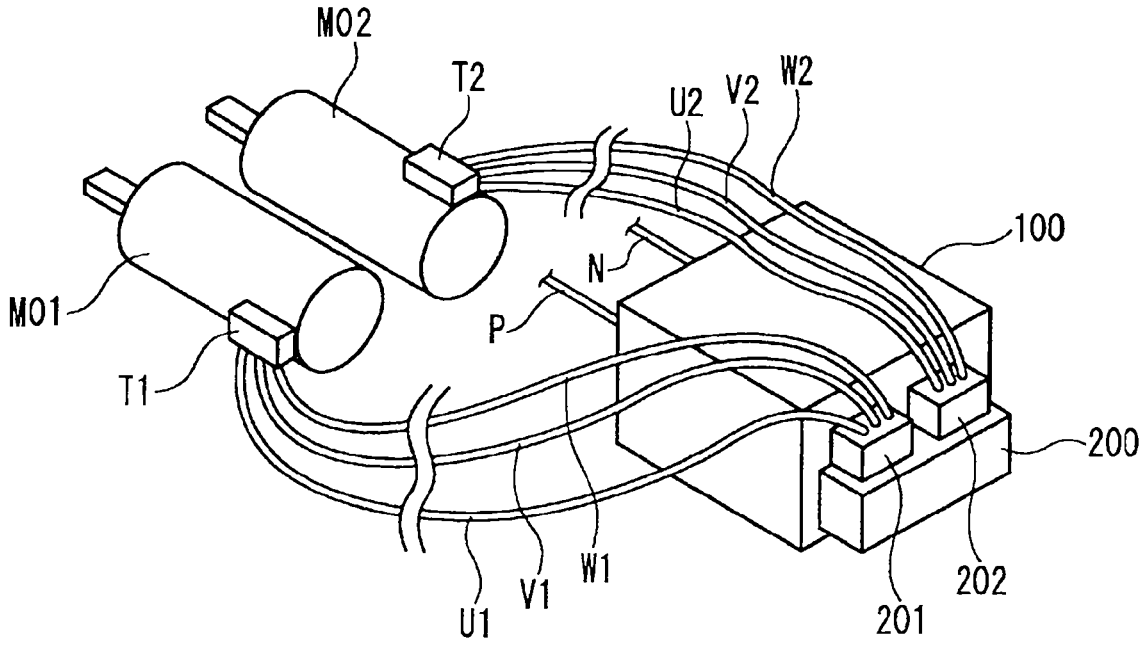

Ba
P
N
INV
100
U
W
V
200
U1
W2
U2
W1
V1
V2
201
202
U1
V1
W1
U2
V2
W2

Fig. 8B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T2
U2
V2
W2
100
N
MO1
P
T1
200
W1
V1
U1
202
201

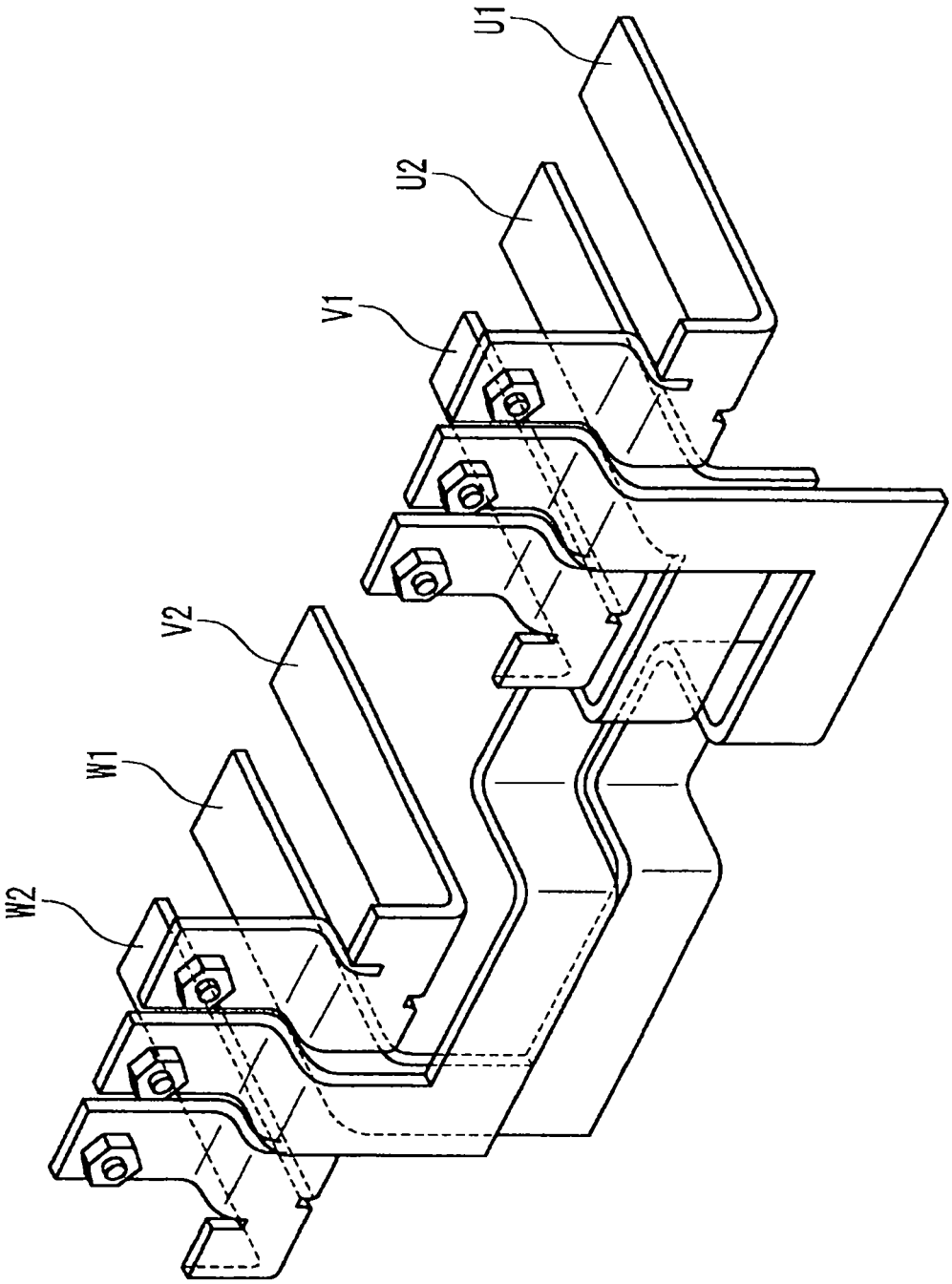
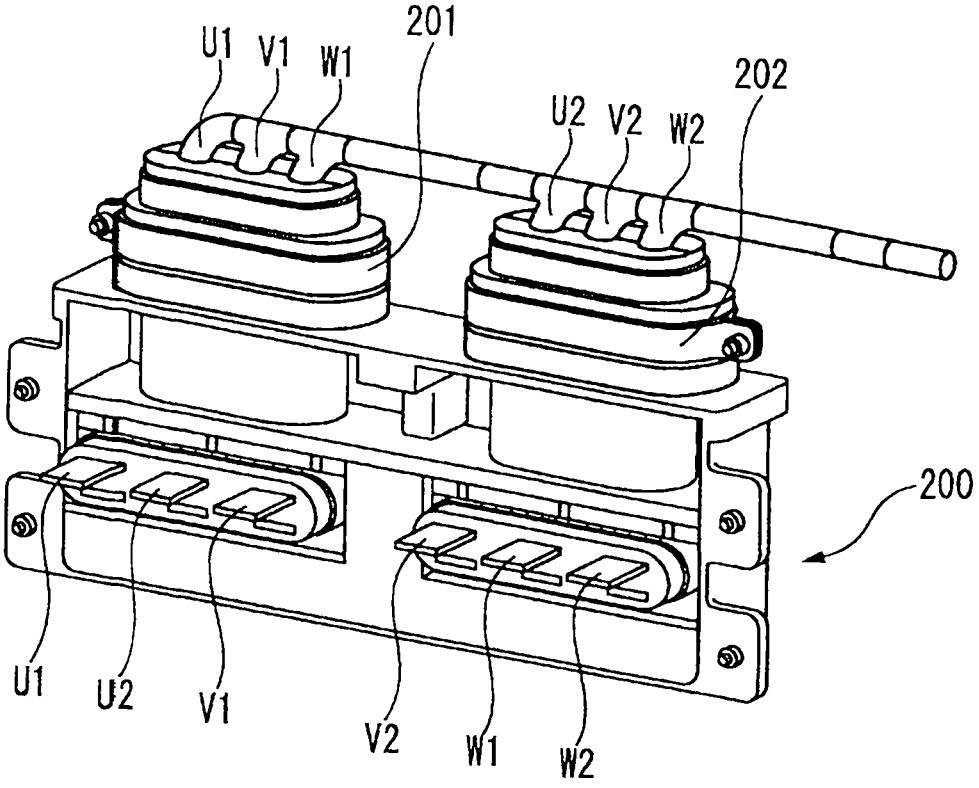


Fig. 9

Fig. 10



CONNECTOR

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of PCT application No. PCT/JP2012/056043, which was filed on Mar. 2, 2012 based on Japanese Patent Application (No. 2011-048331) filed on Mar. 4, 2011, the contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is related to a connector, and more particularly to a connector for direct installation on an inverter for driving two three-phase AC motors in an electric vehicle by one inverter.

2. Description of the Related Art

The connector for direct installation on the inverter for driving two motors by one inverter is known (refer to PTL1).

FIGS. **8**A and **8**B are diagrams illustrating a function of the connector for direct installation, in which FIG. **8**A is a circuit diagram around the connector, and FIG. **8**B is a perspective view illustrating a connector structure.

In FIGS. **8**A and **8**B, a DC voltage from a battery Ba is applied to an inverter INV within an inverter case **100** through a plus line P and a minus line N, and the DC voltage is inverted into three-phase AC voltages of U phase, V phase, and W phase in the inverter INV. A U-phase voltage, a V-phase voltage, and a W-phase voltage of the three phases inverted by the inverter INV are output to a busbar terminal U, a busbar terminal V, and a busbar terminal W, respectively. In order to apply the U-phase voltage, the V-phase voltage, and the W-phase voltage to respective motors M**01** and M**02**, the busbar terminal U, the busbar terminal V, and the busbar terminal W are each branched into two busbar terminals. Accordingly, the busbar terminal U is branched into busbar terminal U**1** and busbar terminal U**2**, the busbar terminal V is branched into busbar terminal V**1** and busbar terminal V**2**, and the busbar terminal W is branched into busbar terminal W**1** and busbar terminal W**2**. The U-phase voltage is output from the busbar terminal U**1** and the busbar terminal U**2** in the inverter case **100**, the V-phase voltage is output from the busbar terminal V**1** and the busbar terminal V**2**, and the W-phase voltage is output from the busbar terminal W**1** and the busbar terminal W**2**. In a connector for direct installation **200** that is installed directly on the inverter case **100**, the busbar terminal U**1** and the busbar terminal U**2**, the busbar terminal V**1** and the busbar terminal V**2**, and the busbar terminal W**1** and the busbar terminal W**2** from the inverter case **100** are collected into two busbar terminal group **1** (busbar terminal U**1**, busbar terminal V**1**, busbar terminal W**1**) and group **2** (busbar terminal U**2**, busbar terminal V**2**, busbar terminal W**2**). The former is output from a connector **201**, and the latter is output from a connector **202**. The U-phase voltage, the V-phase voltage, and the W-phase voltage output from the busbar terminal U**1**, the busbar terminal V**1**, and the busbar terminal W**1** of the connector **201**, respectively, enter a motor side terminal T**1** through a line U**1**, a line V**1**, and a line W**1**, form a rotating magnetic field in the motor M**01**, and drive a rotor.

Likewise, the U-phase voltage, the V-phase voltage, and the W-phase voltage output from the busbar terminal U**2**, the busbar terminal V**2**, and the busbar terminal W**2** of the connector **202**, respectively, enter a motor side terminal T**2** through a line U**2**, a line V**2**, and a line W**2**, form a rotating magnetic field in the motor M**02**, and drive a rotor.

Thus, the respective terminals enter an inlet of the connector **200** in the order of the busbar terminal U**1** and the busbar terminal U**2**, the busbar terminal V**1** and the busbar terminal V**2**, and the busbar terminal W**1** and the busbar terminal W**2**. The connector **200** finally rearranges those respective terminals into one group including the busbar terminal U**1**, the busbar terminal V**1**, and the busbar terminal W**1**, and the other group including the busbar terminal U**2**, the busbar terminal V**2**, and the busbar terminal W**2** by efficiently arranging the busbars, and outputs voltages via those terminals from an outlet of the inverter case **100**.

FIG. **9** is a diagram illustrating a configuration of a busbar within the connector **200** disclosed in PTL1. The connector **200** includes six busbar terminals U**1**, U**2**, V**1**, V**2**, W**1**, and W**2** (hereinafter called "U**1** to W**2**") routed in the inverter case **100**. Terminal parts of six busbar terminals U**1** to W**2** are arranged in parallel in the order of U**1**, U**2**, V**1**, V**2**, W**1**, and W**2** from right of the drawing.

A horizontal terminal part of the rightmost busbar terminal U**1** is continuous to an upward short vertical portion, and bent with a step in substantially an L-shape upward through a horizontal short plate to form a rightmost vertical terminal.

The second right busbar terminal U**2** is bent downward, shortly, and vertically through a horizontal portion, and extends long in substantially a crank shape toward left. A left edge thereof is upward vertical, and bent with a step in substantially an L-shape through a horizontal short plate to form a second left vertical terminal.

The third right busbar terminal V**1** has an upward short vertical part from a horizontal portion, and is bent with a step in substantially an L-shape through a horizontal short plate to form a third vertical terminal.

The fourth right busbar terminal V**2** is continuous to an upward short vertical portion from a horizontal portion, and bent with a step in substantially an L-shape through a horizontal short plate to form a fourth right vertical terminal.

The third and fourth right busbar terminals V**1** and V**2** are bilaterally symmetrically formed.

The fifth right busbar terminal W**1** is bent downward, slightly long, and vertically through a horizontal portion, and extended long in substantially a crank shape toward right. A right edge thereof is an upward vertical part, and bent with a step in substantially an L-shape through a horizontal short plate to form a second right vertical terminal.

The sixth right (left edge) busbar terminal W**2** is bent with a step in substantially an L-shape upward through a horizontal short plate from an upward short vertical portion through a horizontal portion to form a leftmost vertical terminal.

As described above, a busbar assembly of the connector **200** is configured.

As illustrated in FIG. **10**, in the busbar assembly, among the six busbar terminals U**1**, U**2**, V**1**, V**2**, W**1**, and W**2**, the three busbar terminals U**1**, U**2**, and V**1** on the lower left side are fixed by one horizontally long insulating block. The three busbar terminals V**2**, W**1**, and W**2** on the lower right side are fixed by one horizontally long insulating block. Those two insulating blocks are arranged in parallel within one horizontally long shield shell.

Also, the three busbar terminals U**1**, V**1**, and W**1** on the upper left side are arranged a connector fitting chamber of one connector **201**, and the three busbar terminals U**2**, V**2**, and W**2** on the right side are arranged a connector fitting chamber of the other connector **202**. Those six electric wires of the connectors **201** and **202** are bundled and continuous to connectors T**1** and T**2** on the motors M**01** and M**02** (FIG. **8**B) side.

According to the connector **200** disclosed in PTL1, the inverter can be downsized, and moreover connection with the inverter can be ensured easily and efficiently.

When the busbar terminals of the connector for direct installation are integrally molded with the insulating resin part, the alignment (horizontality) of the busbar terminals U**1**, V**1**, W**1**, the busbar terminals U**2**, V**2**, W**2**, the busbar terminals U**1**, U**2**, the busbar terminals V**1**, V**2**, and the busbar terminals W**1**, W**2** may not be ensured, depending on the dimensional relationships or the manufacturing problems of the busbar terminals on the single terminal basis.

Further, even in a state where the alignment of the busbar terminals of the connector for direct installation is ensured, the alignment of the partner connectors **201** and **202** may not be ensured.

Thus, when the connector **200** disclosed in PTL1 is fastened to the partner connectors **201** and **202** under the circumstance where the alignment is not ensured, a load is exerted on a fastening part of the connector **200**, resulting in a risk of an adverse effect that a bolt is loosened when bolt fastening is conducted.

CITATION LIST

Patent Literature

[PTL1] JP-A-2006-81373

SUMMARY OF THE INVENTION

It is therefore one advantageous aspect of the present invention to provide a connector for direct installation in which no load is exerted on a fastening part of the connector when a partner connector is fastened thereto even if the respective alignments of busbar terminal groups of the connector is not ensured.

According to one advantage of the invention, there is provided a connector comprising:

- a busbar including:
  - a first connection part extending in a first direction; and
  - a second connection part extending in a second direction opposite to the first direction at a position displaced from the first connection part in a direction orthogonal to the first direction; and
- a coupling part extending in a direction orthogonal to the first direction and the second direction, and coupling the first connection part and the second connection part;
- a housing including at least one accommodation groove accommodating the coupling part, and a slit through which one of the first connection part and the second connection part is inserted; and
- a cover covering the accommodation groove.

The connector may further comprise a plurality of the busbars, each of which including the first connection part, the second connection part, and the coupling part, wherein the plurality of busbars sterically intersect with each other along the accommodation groove within the housing so that an alignment order of the busbars in the first connection part is different from an alignment order of the busbars in the second connection part.

The connector may be configured such that: the housing includes at least two accommodation grooves accommodating the coupling part respectively, and the accommodation grooves are formed in opposite sides of the housing respectively.

According to another advantage of the invention, there is provided a connector for direct installation on an inverter which is installed directly on the inverter for driving two three-phase loads by one inverter, the connector comprising:

- six busbars having flat and elongated shape;
- a housing formed with three narrow elongated spaces so as to accommodate the six busbars therein;
- an upper cover covering a top of the housing in a vertical direction; and
- an under cover covering a bottom of the housing in the vertical direction,
- wherein each of the busbars includes a first busbar terminal, a second busbar terminal extending in a direction opposite to that of the first busbar terminal, and a coupling busbar coupling the first busbar terminal and the second busbar terminal,
- wherein the coupling busbar is connected to the first busbar terminal perpendicularly, extends by a predetermined length in a plane, turns perpendicularly and extends in the plane, turns perpendicularly to a opposite side with respect to the first busbar terminal in the plane, extends by a predetermined length, and is connected to the second busbar terminal perpendicularly,
- wherein two of the narrow elongated spaces are arranged in parallel with each other with an interval in a cross section orthogonal to an elongating direction thereof, and the other one of the narrow elongated spaces is arranged in a plane in which one of the two narrow elongated spaces is arranged at a side of the under cover, and
- wherein the coupling busbars are accommodated in the narrow elongated spaces with a clearance in a widthwise direction which is orthogonal to the elongating direction, so that both of the first busbar terminal and the second busbar terminal move in the vertical direction within the housing.

The coupling busbars of the busbars for a U phase and a W phase among the six busbars may be accommodated in the two narrow elongated spaces arranged in parallel, and the coupling busbars of the busbars for a V phase may be accommodated in the other one of the narrow elongated spaces.

According to the present invention, the busbars do not need to be insert-molded, and are inserted in the grooves along the surfaces of the coupling part. Therefore, the terminals are easily positioned with respect to a structure of a divided housing that holds the coupling parts from both sides thereof.

According to the present invention, there is required no jig for ensuring an insulating distance between the busbars at the time of conducting the insert molding. Also, when a sterical intersection is conducted in the structure of the divided housing that holds the coupling parts from both sides thereof, there is a need to further provide an insulating member therebetween. On the contrary, the present invention does not require the insulating member.

According to the present invention, even when the number of busbars is increased, and the busbars complicatedly intersect with each other, the busbars are inserted from both ends of the housing so that insulation can be ensured in a planar direction and the widthwise direction of the coupling part. Also, when the sterical intersection is conducted in the structure of the divided housing that holds the coupling parts from both sides thereof, there is a need to further provide the insulating member therebetween. On the contrary, the present invention does not require the insulating member.

According to the present invention, even when each alignment of the busbar terminal groups of the connector for direct installation cannot be conducted, when the connector is fastened to the partner connector, the busbar terminals can move vertically within the housing. Therefore, because a design

error is absorbed by the busbar terminals, no load is exerted on the fastening part of the connector for direct installation.

According to the present invention, the respective busbars can be efficiently arranged within the thin elongated housing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of a connector for direct installation according to the present invention.

FIG. **2** is a perspective view illustrating a state in which only six busbars are assembled according to the present invention.

FIG. **3** is a perspective view illustrating a state in which the six busbars of FIG. **2** are accommodated in a housing.

FIG. **4** is a perspective view illustrating a state immediately before a busbar terminal group A and a busbar terminal group B are inserted into the housing.

FIG. **5** is a perspective view illustrating a state immediately after the busbar terminal group A and the busbar terminal group B in FIG. **4** are inserted into the housing, but immediately before the housing is covered with an outer cover and a lower cover.

FIGS. **6**A and **6**B are perspective views illustrating a complete state in which the housing is covered with the outer cover and the lower cover of FIG. **5**, in which FIG. **6**A is a perspective view from a center busbar terminal side, and FIG. **6**B is a perspective view from an end busbar terminal side.

FIG. **7** is a vertical cross-sectional view of the connector for direct installation in the complete state of FIGS. **6**A and **6**B.

FIGS. **8**A and **8**B are diagrams illustrating a function of the connector for direct installation, in which FIG. **8**A is a circuit diagram of a periphery of the connector, and FIG. **8**B is a perspective view illustrating a connector structure.

FIG. **9** is a diagram illustrating a configuration of busbars within a connector **200** disclosed in PTL1.

FIG. **10** is a perspective view illustrating the connector for direct installation integrally molded with an insulating resin disclosed in PTL1.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Hereinafter, a connector in which there is no need to subject busbars to insert molding, and terminals are easily positioned with respect to a structure of a divided housing that holds coupling parts from both sides thereof will be described on the basis of an embodiment of a specific connector for direct installation with reference to FIGS. **1** to **7**.

FIG. **1** is an exploded perspective view of a connector for direct installation according to the present invention. Referring to FIG. **1**, the connector includes an upper cover **30**, a first busbar terminal group **10**A, a housing **20**, a second busbar terminal group **10**B, and an under cover **40** in order from right.

Hereinafter, a description will be given of a busbar terminal group **10** which includes the first busbar terminal group **10**A and the second busbar terminal group **10**B, the housing **20**, the upper cover **30**, and the under cover **40** in the stated order.

Referring to FIGS. **1** to **7**, according to this embodiment, the busbar terminal group **10** includes six busbars in total, that is, a U-phase first terminal U**1** and a U-phase second terminal U**2**, a V-phase first terminal V**1** and a V-phase second terminal V**2**, and a W-phase first terminal W**1** and a W-phase second terminal W**2**.

Among those terminals, the U-phase first terminal U**1** and the U-phase second terminal U**2**, and the W-phase first terminal W**1** and the W-phase second terminal W**2** configure the first busbar terminal group **10**A, and the V-phase first terminal V**1** and the V-phase second terminal V**2** configure the second busbar terminal group **10**B.

The busbar terminals in the busbar terminal group **10** are common in basic configuration to each other, and therefore a configuration of the U-phase first terminal U**1** (busbar terminal U**1**) will be exemplified.

The U-phase first terminal U**1** includes a center busbar terminal U**11** (FIGS. **2** and **7**) that extends perpendicular to a housing surface from a neighborhood of a center line extending through a center of a short axis of the housing **20** in a long direction, an edge busbar terminal U**13** (FIGS. **2** and **7**) that extends perpendicular to an opposite surface of the housing surface from a longitudinal margin of the housing **20** in an opposite direction of the center busbar terminal, and a coupling busbar U**12** (FIG. **2**) that couples the center busbar terminal U**11** and the edge busbar terminal U**13**, in a complete state where the U-phase first terminal U**1** is assembled into the thin elongated housing **20** (FIG. **2**).

Further, the coupling busbar U**12** includes a first bent part B**1** (FIG. **1**) that is bent at 90° on an edge of the center busbar terminal U**11**, a first straight part S**1** (FIG. **1**) that straight extends from the first bent part B**1**, a first direction turn part K**1** (FIG. **1**) that turns in the long direction of the housing **20** into a 90° crank shape on an edge of the first straight part S**1**, a second straight part S**2** (FIG. **1**) that straight extends from the first direction turn part K**1** in the long direction of the housing **20**, a second direction turn part K**2** (FIG. **1**) that turns in an opposite direction to that of the first direction turn part K**1** from the long direction of the housing **20** into the 90° crank shape on an edge of the second straight part S**2**, a third straight part S**3** (FIG. **1**) that straight extends from the second direction turn part K**2** in the edge busbar terminal direction, and a second bent part B**2** (FIG. **1**) that is bent on an edge of the third straight part S**3** and coupled to the edge busbar terminal U**13**.

All of the coupling busbars U**12**, U**22**, V**12**, V**22**, W**12**, W**22** are identical in the configuration with the U-phase first terminal U**1** in principle. Only lengths and directions of the coupling busbars U**12**, U**22**, V**12**, V**22**, W**12**, W**22** are different from those of the U-phase first terminal U**1**. Each of the coupling busbars U**12**, U**22**, V**12**, V**22**, W**12**, W**22** includes the first bent part B**1** that is bent at 90° on the edge of the center busbar terminal U**11**, U**21**, V**11**, V**21**, W**11**, W**21**, the first straight part S**1** that straight extends from the first bent part B**1**, the first direction turn part K**1** that turns in the long direction of the housing **20** into the 90° crank shape on the edge of the first straight part S**1**, the second straight part S**2** that straight extends from the first direction turn part K**1** in the long direction of the housing **20**, the second direction turn part K**2** that turns in the opposite direction to that of the first direction turn part K**1** from the long direction of the housing **20** into the 90° crank shape on the edge of the second straight part S**2**, the third straight part S**3** that straight extends from the second direction turn part K**2** in the edge busbar terminal direction (U**13**, U**23**, V**13**, V**23**, W**13**, W**23**), and the second bent part B**2** that is bent on the edge of the third straight part S**3** and coupled to the edge busbar terminal.

Differences between the busbar terminal group **10**A and the busbar terminal group **10**B reside in a bent direction of the first bent part B**1**, and a length of the third straight part S**3**.

The first bent part B**1** of the busbar terminal group **10**A is bent toward the upper cover **30** side whereas the first bent part B**1** of the busbar terminal group **10**B is bent toward the under cover **40** side.

The length of the third straight part S**3** of the busbar terminal group **10**A is equal to or shorter than half of a length of the

housing **20** in a short axial direction thereof in a state where the third straight part S**3** of the busbar terminal group **10**A is assembled into the housing **20** whereas the length of the third straight part S**3** of the busbar terminal group **10**B is equal to the length of the housing **20** in the short axial direction thereof.

Referring to FIGS. **1** to **7**, the U-phase first terminal U**1** and the W-phase second terminal W**2** are basically symmetric with respect to a center line extending through a center of a long axis of the housing **20** in a short direction.

The U-phase second terminal U**2** and the W-phase first terminal W**1** are also basically symmetric with respect to a center line extending through a center of a long axis of the housing **20** in the short direction. In arrangement, since the respective second straight parts S**2** are located to collide with each other, only one second straight part S**2** (S**2** of W**12** in FIG. **1**) is so configured as to be bent upward to avoid collision.

The center busbar terminals (U**11**, U**21**) of the respective first and second terminals of the U phase, and the center busbar terminals (W**11**, W**21**) of the respective first and second terminals of the W phase are arranged on the same plane M**1** (FIG. **7**) (refer to FIG. **2**).

The edge busbar terminals (U**13**, U**23**) of the respective first and second terminals of the U phase, and the edge busbar terminals (W**13**, W**23**) of the respective first and second terminals of the W phase are arranged on the same plane M**2** (FIG. **7**) (refer to FIG. **2**).

All of the coupling busbars (U**12**, U**22**, W**12**, W**22**) of the respective first and second terminals of the U phase and the W phase are arranged on the same plane M**3** except for the second straight part S**2**, the second direction turn part K**2**, and the third straight part S**3** of the W-phase first terminal W**12**. The second straight part S**2**, the second direction turn part K**2**, and the third straight part S**3** of the W-phase first terminal W**12** are arranged on the same plane M**4** (FIG. **7**).

The second busbar terminal group **10**B includes a V-phase first terminal V**1** and a V-phase second terminal V**2**.

Referring to FIG. **1**, the V-phase first terminal V**1** and the V-phase second terminal V**2** are symmetric with respect to the center line extending through a center of a long axis of the housing **20** in the short direction.

The center busbar terminals (V**11**, V**21**) of the first and second terminals of the V phase are arranged on the plane M**1** (FIG. **7**).

The edge busbar terminals (V**13**, V**23**) of the first and second terminals of the V phase are arranged on the same plane M**2** (FIG. **7**).

The coupling busbar terminals (V**12**, V**22**) of the first and second terminals of the V phase are arranged on the above plane M**4** (FIG. **7**).

As illustrated in FIG. **1**, the housing **20** is formed of a thin elongated insulator in which the following three narrow elongated spaces **20**S**1**, **20**S**2**, and **20**S**3** (FIG. **7**) are formed in a portion sandwiched between one long surface **20**B (FIGS. **4**, **7**) and a long surface **20**F (FIGS. **4**, **7**) on an opposite side thereof.

The first space **20**S**1** is a portion where the coupling busbar U**22** group is accommodated in FIG. **7**. The first space **20**S**1** is a chamber arranged in the long direction, which accommodates the coupling busbar U**12** of the U-phase first terminal, the coupling busbar U**22** of the U-phase second terminal, the first direction turn part K**1** of the W-phase first terminal W**12**, and the coupling busbar W**22** of the W-phase second terminal, which are aligned on the plane M**3**. Gaps between the respective busbars are partitioned by insulating ribs.

The second space **20**S**2** is a portion where the coupling busbar W**12** group is accommodated in FIG. **7**, which is a chamber arranged in the long direction, which accommodates the coupling busbar W**12** and the second direction turn part K**2** of the W-phase first terminal W**12** on the plane M**4** therein. A gap between the first space and the second space is partitioned by an insulating rib.

The third space **20**S**3** is a portion where the coupling busbar V**12** group is accommodated in FIG. **7**. The third space **20**S**3** includes a chamber arranged in the long direction, which accommodates the coupling busbar V**12** of the V-phase first terminal V**1** and the coupling busbar V**22** of the V-phase second terminal V**2**, which are aligned on the plane M**4**, and a chamber arranged in the short direction, which accommodates the third straight part S**3** of the coupling busbar V**12** of the V-phase first terminal V**1** and the third straight part S**3** of the coupling busbar V**22** of the V-phase second terminal V**2**, which turn at a right angle to the former chamber from both ends thereof. A gap between the first space and the third space, and a gap between the second space and the third space are each partitioned by an insulating rib.

At the portion sandwiched between the long surface **20**B and the long surface **20**F, all of the coupling busbars (U**12**, V**12**, W**12**, U**22**, V**22**, W**22**) of the U, V, and W phases are inserted and accommodated into those three narrow elongated spaces **20**S**1**, **20**S**2**, and **20**S**3** from arrows indicated in FIG. **4**.

That is, the coupling busbars (U**12**, W**12**, U**22**, W**22**) of the U phase and the W phase are inserted from a direction of an arrow F**1** in FIG. **1**. However, among the coupling busbars of the U phase and the W phase, the three coupling busbars (U**12**, U**22**, W**22**) are inserted in a lower space (first space **20**S**1** in FIG. **7**) of the housing in FIG. **4**, and the coupling busbar (W**12**) of the W-phase first terminal is inserted into an upper space (second space **20**S**2** in FIG. **7**) of the housing in FIG. **4**.

Also, the coupling busbars (V**12**, V**22**) of the V phase are inserted into an upper space (third space **20**S**3** in FIG. **7**) of the housing in FIG. **4** from a direction of an arrow F**2** in FIG. **4**. The housing **20** is provided with spaces **20**M**22** and **20**M**22** (FIG. **1**) in which the third straight parts S**3** of the coupling busbars (V**12**, V**22**) of the V phase are accommodated as parts of the third space.

The center busbar terminals (U**11**, U**21**, V**11**, V**21**, W**11**, W**21**) extending from the coupling busbars accommodated in the spaces are exposed from a lower portion of the long surface **20**F (FIG. **7**) in the horizontal direction. Also, the edge busbar terminals (U**13**, U**23**, V**13**, V**23**, W**13**, W**23**) extending from the coupling bas bars accommodated in the spaces toward the opposite side are exposed from an upper portion of the long surface **20**B (FIG. **7**) horizontally in the opposite direction to that of the center busbar terminals.

FIG. **5** illustrates a state of the six busbars having the configuration according to the present invention, which are thus inserted into the housing **20** and supported.

When the upper cover **30** and the under cover **40** are engaged with the upper portion and the lower portion of the housing **20**, respectively, as described below, the connector for direct installation according to the present invention is completed as illustrated in FIGS. **6**A and **6**B.

The outside of the housing **20** is equipped with engagement projections **20**K**3** to **20**K**5** on a portion engaged with the upper cover **30**, and engagement projections **20**K**1** and **20**K**2** on sites engaged with the under cover **40**.

The upper cover **30** is made of insulator, and provided with engagement holes **30**K**3** to **30**K**5** on sites engaged with the engagement projections **20**K**3** to **20**K**5** outside of the housing

20. The engagement projections 20K3 to 20K5 of the housing 20 are engaged with the engagement holes 30K3 to 30K5 of the upper cover 30 as illustrated in FIGS. 6A and 6B, as a result of which the upper cover 30 covers the housing 20, the coupling busbars U12, U22, and W22 are not removed from the first space 20S1 (FIG. 7), and the coupling busbar W12 is not removed from the second space 20S2 (FIG. 7).

The under cover 40 is made of insulator, and provided with engagement holes 40K1 and 40K2 on sites engaged with the engagement projections 20K1 and 20K2 outside of the housing 20. The engagement projections 20K1 and 20K2 of the housing 20 are engaged with the engagement holes 40K1 and 40K2 of the under cover 40 as illustrated in FIGS. 6A and 6B, as a result of which the under cover 40 covers the housing 20, the coupling busbars V12 and V22 are not removed from the third space 20S3.

According to the present invention, as illustrated in FIG. 7, the thick portions of the busbars are inserted into the narrow spaces of the thin elongated housing 20, and covered with the upper cover 30. With this configuration, the internal accommodation spaces are set to be larger than the width dimensions of the busbars by clearances t3 and t4 so that the busbars can move vertically within the spaces.

Likewise, the accommodation spaces formed by the under cover 40 are set to be larger than the busbar dimensions so as to provide clearances.

Thus, when the thick portions of the busbars having the creative configuration are inserted into the narrow spaces of the thin elongated housing 20, and covered, the clearances are formed in which the busbars slightly move within the space. As a result, a dimension error of partner parts can be absorbed, resulting in no need to enhance the manufacture precision of the partner parts. Also, there is no need to enhance the dimension precision of the single busbar as compared with the mold parts, and the parts are easily manufactured.

The present invention is useful for providing a connector for direct installation in which no load is exerted on a fastening part of the connector when a partner connector is fastened thereto even if the respective alignments of busbar terminal groups of the connector are not ensured.

What is claimed is:

1. A connector comprising:

a busbar comprising:

a first connection part extending in a first direction;

a second connection part extending in a second direction opposite to the first direction at a position displaced from the first connection part in a direction orthogonal to the first direction; and

a coupling part extending in a direction orthogonal to the first direction and the second direction, and coupling the first connection part and the second connection part;

a housing including at least one accommodation groove accommodating the coupling part, and a slit through which one of the first connection part and the second connection part is inserted; and

a cover covering the accommodation groove,

wherein the connector further comprises a plurality of busbars, each of which includes a first connection part, a second connection part, and a coupling part, the plurality of busbars sterically intersect with each other along the accommodation groove within the housing so that an alignment order of the plurality of busbars in the first connection part is different from an alignment order of the plurality of busbars in the second connection part,

the housing includes at least two accommodation grooves accommodating the coupling part respectively,

the accommodation grooves are formed in opposite sides of the housing respectively, and

the cover, the busbar, and the housing are separate parts, and the coupling part of the busbar is sandwiched between the cover and the accommodation groove of the housing.

2. The connector of claim 1, wherein the connector comprises three busbars in which a first busbar corresponds to a U-phase voltage of an inverter, a second busbar corresponds to a V-phase voltage of the inverter, and a third busbar corresponds to a W-phase voltage of the inverter.

3. The connector of claim 1, wherein the coupling part of the busbar is configured to partially move while sandwiched between the cover and the accommodation groove of the housing.

4. A connector for direct installation on an inverter which is installed directly on the inverter for driving two three-phase loads by one inverter, the connector comprising:

six busbars having flat and elongated shape;

a housing formed with three narrow elongated spaces so as to accommodate the six busbars therein;

an upper cover covering a top of the housing in a vertical direction; and

an under cover covering a bottom of the housing in the vertical direction,

wherein each of the busbars includes a first busbar terminal, a second busbar terminal extending in a direction opposite to that of the first busbar terminal, and a coupling busbar coupling the first busbar terminal and the second busbar terminal,

wherein the coupling busbar is connected to the first busbar terminal perpendicularly, extends by a predetermined length in a plane, turns perpendicularly and extends in the plane, turns perpendicularly to an opposite side with respect to the first busbar terminal in the plane, extends by a predetermined length, and is connected to the second busbar terminal perpendicularly,

wherein two of the narrow elongated spaces are arranged in parallel with each other with an interval in a cross section orthogonal to an elongating direction thereof, and the other one of the narrow elongated spaces is arranged in a plane in which one of the two narrow elongated spaces is arranged at a side of the under cover, and

wherein the coupling busbars are accommodated in the narrow elongated spaces with a clearance in a widthwise direction which is orthogonal to the elongating direction, so that both of the first busbar terminal and the second busbar terminal move in the vertical direction within the housing.

5. The connector as set forth in claim 4, wherein

the coupling busbars of the busbars for a U phase and a W phase among the six busbars are accommodated in the two narrow elongated spaces arranged in parallel, and the coupling busbars of the busbars for a V phase are accommodated in the other one of the narrow elongated spaces.

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